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Meaning and Familiarity in Associative Learning

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Psychological Monographs: General and Applied

MEANING AND FAMILIARITY IN ASSOCIATIVE LEARNING[1]

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It is taken for granted that meaningful material is learned more easily than nonmeaningful material. McGeoch and Irion (1952) write that "a high positive correlation between meaningfulness of material and rate of learning holds under a very wide range of conditions" (p. 479). Thus, when subjects are given the task of learning a list of meaningful items (e.g., adjectives) and a list of nonsense syllables of identical length, the adjective list is learned to criterion in fewer trials. Also, structured sequences of words (e.g., sentences) are easier to learn than lists of randomly selected words.

Demonstrations of this nature together with other related experimental findings have led to the general acceptance of the facilitating role of meaningfulness. They have not, however, produced any unanimity in accounting for this effect of meaning. Five principal explanations which have been advanced are:

1. *Associationist explanation.* Meaningfulness as a determinant of learning gains its status as a consequence of positive transfer. Meaningful material allows the learner to draw on a vast store of previously established associations. As a result, the present process of learning has only to strengthen some particular bond between the items which was already in existence. Pairs of nonsense syllables, on the other hand, do not enjoy the advantages of previously formed associations; since they require the formation of new associational bonds, they are more difficult to learn.

Recently, this point of view has been restated in a somewhat modified way. For example, Mandler and Huttenlocher (1956) state that the learning of new associations is "mediated by previously learned associations to the stimulus- and response-terms" (p. 424). Therefore, "the more such associations are elicited by the stimulus- and response-members in a paired-associate task, the greater will be the probability that a particular combination of a stimulus-association and a response-association can be found to provide a mediating bridge or a 'meaningful' link between the two" (p. 424). Mandler and Huttenlocher asked subjects to associate to each of a number of nonsense syllables for an interval of 30 seconds. The syllables were then ranked according to associative frequency (i.e., the number of associations evoked). Subjects were then given the task of learning a list of eight pairs of syllables, each pair having a different level of associative frequency. A significant correlation was obtained, "between speed of acquisition of a nonsense-syllable pair and the mean associative frequency previously established for its two components" (p. 428).

Presumably, the same reasoning could be applied to explain the facilitative effect of meaning. A meaningful word would evoke a greater number of associations and, therefore, pairs of such words would be more likely to have "mediating bridges."

2. *Organizational explanation.* A second point of view, represented by Köhler

[1] This investigation was conducted when the first two authors were at the New School for Social Research and was supported in part by Research Grant M-2082, National Institute of Mental Health, Public Health Service.

(1929), contests the associationist explanation "mainly because the same words have occurred thousands of times in other much more regular connections, which ought absolutely to inhibit the assumed associations in this particular case" (p. 287). This inhibition is to be expected particularly where one takes pains to pair words which would not have been experienced together often, if at all, in the past. Köhler argues that the emphasis on association is misplaced and that the true explanation must be made in terms of the possibilities for organizing the learning material. That is, if while reading the pair of nouns, pen—girl, the learner visualizes a girl writing with a pen, then the learner will have "experienced some well organized . . . whole,[2] and it may be that here learning is so easy because organizing is so much easier in this case than in that of indifferent nonsense syllables" (Köhler, 1929, pp. 287–288). If we determine which material is more amenable to organization and in turn determine where association is strongest, we shall find them coincident. Thus, "where organization is naturally strong we have spontaneous association; where there is practically no organization association does not occur until some organization is created intentionally" (Köhler, 1929, p. 290). Köhler points out that if the noun pairs, lake—sugar, pencil—gasoline, etc. are presented to a group of subjects, they will be learned more easily than an equal number of nonsense syllable pairs. Certainly, Köhler argues, no one can say that between such categorically disparate items as pencil and gasoline there exist old associations which merely require some degree of repetition or exercise for success in the learning task. If learning is facilitated under these conditions it can be only as a result of organization. It should be noted that Köhler's arguments do not apply to the more recent versions of the associationistic view, e.g., Mandler and Huttenlocher.

3. *Familiarity explanation.* This approach, which is similar to Robinson's (1932) "law of acquaintance" would view the theories described above as superfluous. The crucial factor is the familiarity of the individual items used in the learning task. Meaningful material is also familiar; therefore, it would be easier to master a list of pairs of meaningful items than nonsense items. When adjectives are used the learner does not have to be concerned with mastering the individual items; these are already familiar and thus easily distinguishable. He can concentrate mainly on forming an association between the members of a pair. Where nonsense material is used, the learner must first learn the individual unfamiliar items and, in addition, form an association between the items. The additional task would make nonsense material harder to learn.

There is some experimental evidence bearing on this argument. Waters (1939) reported that prefamiliarizing nonsense syllables did not facilitate learning. He demonstrated that varying amounts of prior reading and reciting of syllables did not significantly facilitate learning them in a new order. In his experiment three conditions were compared:

Condition I. The subjects first read aloud the list to be learned three times. They then proceeded to the formal learning of the list. The serial order for learning was the same as for initial reading.

Condition II. The same as Condition I except that the order of syllables for learning was different from that during the initial reading.

Condition III. Learning without any prior reading of the list.

Waters considered the comparison between Conditions II and III to be the crucial test for the effect of familiarization. He found no difference in the number of trials to learn the lists under the two procedures.

Sheffield, however, did not confirm Waters' conclusions. In Sheffield's (1946) study, syllables were prefamiliarized by a procedure which did not involve the formation of associations between syllables. In the prefamiliarization session the subject saw the word or syllable, vocalized it, then

[2] We shall refer to such organized wholes as "conceptual units."

tried to find it quickly in a list of three-letter words. When the word was found, it was marked and vocalized again. These items were then paired and compared with pairs of new items. The prefamiliarized pairs were learned more easily than the new pairs.

A third study on the role of familiarity has been reported by Hovland and Kurtz (1952). These authors suggest that Waters failed to demonstrate an effect of prior familiarization because his technique required the unlearning of associations which were formed during learning. In their experiment, 12 subjects learned lists of 6, 12, and 24 nonsense syllables, both with and without prior familiarization of the items. The prefamiliarization technique consisted in having the subjects study the nonsense syllables which were presented in constantly changing order until they knew the syllables well enough to recognize them and also to supply the missing letters when parts of the syllables were presented. The effect of prior familiarity with the syllables was to reduce the number of trials to mastery by a moderately constant amount for all lengths of lists.

While familiarity (in the sense described above) has been shown to play a role in associative learning, the evidence is not sufficient to prove that the superiority of meaningful material is entirely due to this factor.

Explanations closely allied to the familiarity and association approaches have appeared in recent years. These stress the role of linguistic structure and patternings rather than the familiarity of the items or the mediation by specific associations:

4. *Transitional (or sequential) probability.* Words or letters in speech and writing do not appear in random sequences but follow one another in predetermined orders. Transitional analysis investigates the dependent probabilities of sequences of linguistic units:

Given the unit "x," what is the probability that it will be followed by unit "y"? Some sequences never appear in English while others vary in frequency of occurrence. The letter "q," for example, is never followed by any letter other than "u"; there is a greater likelihood that "e," as the first letter of a word, will be followed by "n" or "s" than by "y." The word "is" or "says" will more likely occur after "he" than will "electron." Higher order probabilities can be obtained by posing the question: given the sequence of units XY or XYZ, what is the probability that a particular unit will be the next to appear?

Miller and Selfridge (1950) argue that sequences of high transitional probability will be easier to learn than those of low frequency. To obtain evidence for this hypothesis, they constructed word sequences with different orders of approximation to standard English. For example, a zero-order was derived by selecting words at random from a dictionary. For a first-order approximation, a word is chosen if it frequently follows one word before it; for a second-order, two words before it, etc. The Shannon technique was used to generate the various degrees of approximation. The subjects were given the task of learning 10-, 20-, 30- and 50-word passages ranging in sequential probability from a zero-order to text passages. The results based on an immediate recall test are in accordance with the hypothesis that higher-order sequences are learned more readily than are lower ones.

An important finding in this experiment is that above the fifth-order there is very little improvement in recall for all sequence lengths. Some passages of low order were learned as well as text passages. For example, the third-order 20-word nonsense sequence—"family was large dark animal came roaring down the middle of my friends love books passionately every kiss is fine"—was learned as well as a "sensible" passage of 20 words taken from text.

Miller and Selfridge (1950) conclude from this result that it is not meaning per se which facilitates learning but the presence of sequences frequently encountered in the past:

> Thus there are kinds of nonsense that are as easy to recall as are meaningful passages. The significant distinction is not to be drawn between

meaning and nonsense but between materials that utilize previous learning and permit positive transfer and materials that do not. If the nonsense preserves the short range associations of the English language that are so familiar to us, the nonsense is easy to learn (p. 183).

Word pairs or sequences which occur together frequently in speech and writing have built up strong associations and are therefore easier to learn when presented in an experiment than are nonsense syllables or random assortments of words.

It is apparent that the concept of transitional probability as applied to the problem of associative learning is essentially a restatement of the first approach considered above.

5. *Grammatical habits.* Almost all of the verbal arrangements we experience and produce are ordered according to the rules of syntax. Nevertheless, a sentence, for example, cannot be defined simply as a highly probable sequence of words. Linguists distinguish between syntactical order and dependent probability computations.

"One's ability to produce and recognize grammatical utterances is not based on notions of statistical approximation and the like" (Chomsky, 1957, p. 16). Again, "If we rank the sequences of a given length in order of statistical approximation to English, we will find both grammatical and ungrammatical sequences scattered throughout the list; there appears to be no particular relation between order of approximation and grammaticalness" (Chomsky, 1957, p. 17). Grammatical structure can be easily recognized even in an arrangement of nonsense syllables, e.g., "The vapy koobs desaked the citar molently" (Fries, 1952, p. 111).

It can be assumed that the great frequency of grammatical sequences in our experience has given rise to verbal habits or learning sets. These habits would facilitate the learning of new material arranged in accordance with grammatical structure; in this case, there will be positive transfer from previous learning of material with the same structure. Ungrammatical or random sequences of words would be more difficult to learn.

Some evidence for this view is cited by Osgood (1957):

> . . . one of my students, Mr. Albert Swanson, compared the ease of learning nonsense sequences that retained the structure of the English sentences from which they were derived, for example,
>
> The maff vlems oothly um the glox nerfs,
>
> with matched materials in which the grammatical cues had been eliminated, for example,
>
> maff vlem ooth um glox nerf.
>
> The structured series were learned more easily than random lists (p. 88).

We have reviewed several explanations for the superiority of meaningful material in learning. Four of these account for the effect in terms of transfer from previous learning of one kind or another—of specific items, associations, verbal sequences, or grammatical habits. Köhler's explanation is the only one based on the referential aspect of language. As we have seen, there is some evidence that familiarity factors are important. But this kind of evidence does not necessarily rule out the role of meaning.

In the experiments to be reported in this paper we attempt to distinguish meaning from familiarity and to investigate the separate contributions of these factors in paired-associate learning.

We know of only one study—by Sheffield (1946)—which deals with this problem. As stated above, Sheffield found that familiarized items are easier to associate than are novel ones. He also raises the question as to whether meaning makes an additional contribution in the learning process. Sheffield defines meaning in S–R terms as the perceptual response which is aroused by a stimulus pattern; this perceptual response is implicit and has been connected to the stimulus pattern by past learning. According to this definition, all familiar stimuli have meaning based on past experience and even novel stimuli may have some meaning based on stimulus generalization. Sheffield attempted to make an item meaningful by attaching a distinctive perceptual response to a word or syllable ("symbolic training"). For example, when the subject saw item X, he was to circle it with a green crayon; item Y was to be blacked out with a pencil, etc. In familiarity training the response was the same to all stimuli used.

The paired-associate learning task was designed so that prefamiliarized material and material which had been made "meaningful" by symbolic training could be compared with novel items. The results show that familiarity and meaning were equally effective. "Symbolic training had no effect other than the correlated familiarization" (Sheffield, 1946, p. 194).

More recently, other stimulus–response definitions of meaning (Osgood, 1953; Noble, 1952) have been proposed. In the present study we are not concerned with the problem of the functional nature of meaning—whether it consists of autonomic responses or cortical events. For our purposes, the dictionary definition of meaning, as that which is named or referred to by a word, seems adequate. The sound CAT is meaningful when used by the speaker and comprehended by the listener to refer to a particular object or class of objects. Words may also refer to events, activities, abstract concepts, etc.

Of course, a word must be familiar in order to be meaningful; a novel word (in isolation) could have no meaning. Nevertheless, familiarity in itself may not give rise to meaning. The syllable "GYX" may become quite well-known with repetition, yet when heard or read it does not arouse any experience beyond itself—no object, concept, or activity is referred to or named. It is therefore meaningless.

Some classes of familiar linguistic units possess structural meanings (Fries, 1952), i.e., they are meaningful only as parts of a sentence. In isolation such words as "who," "the," "for," etc., do not refer to or identify any kind of experience. Words like "cat," "table," "run," "talk," "war," "pretty," on the other hand, do not have to be given in a larger verbal context to have meaning. Presented by themselves, these words will call up specific mental content. One has no difficulty in defining any one of them; "the," however, can be defined only as a member of a particular class of words, or as having a particular grammatical function.

We shall, therefore, use the term "meaningful" to refer to types of words such as nouns, verbs, and adjectives, for which lexical meanings can be readily elicited when they are presented by themselves. The term "familiar" will be applied to nonsense syllables which have been experienced previously and also to types of words such as prepositions and conjunctions. (It is perhaps preferable to say that these latter words have meaning only in the limited sense described above than to call them entirely meaningless.)

The hypotheses which guided the experimentation to be reported were:

1. Familiarity by itself will facilitate associative learning.

2. Meaning will enhance learning even more because it makes possible organization or conceptual unit formation as described by Köhler.

Plan of Research

To obtain evidence for these hypotheses the following studies were carried out:

1. The effect of familiarity. For this purpose, prefamiliarized nonsense syllables were compared with novel ones (Experiment I).

2. The effect of meaningfulness. Meaningful words (nouns) were compared with equally familiar words of limited meaning (conjunctions and prepositions) and nonsense syllables (Experiments II and III).

3. The explanation of the superiority of conjunctions and prepositions over nonsense syllables found in Experiments II and III. To see whether this result is due to familiarity or to the limited meaning of the former items, conjunctions were compared with familiar nonsense items (Experiment IV).

4. The role of transitional probability. To see whether the superiority of meaningful words over merely familiar ones (Experiment II and III) can be attributed to this factor, we compared noun pairs with pairs of words which possessed high transitional probability (Experiment V).

5. The role of organization or conceptual unit formation. Pairs of pictures representing specific objects were compared with concrete noun, abstract noun, and verb pairs

(Experiment VI). Further, pairs of nouns joined by a "sensible" connecting word were compared with pairs having an irrelevant connective (Experiment VIIa) and, finally, pairs of pictures of objects which were arranged to form a unit were compared with picture pairs in which the items remained separated as in the traditional paired-associates method (Experiment VIIb).

Experiment I

In the first experiment we were interested in demonstrating the facilitative effect of familiarity with material made familiar during the experimental period.

Method and Materials

The general procedure consisted in prefamiliarizing nonsense syllables which were later formed into pairs to be learned as paired associates. Learning of the prefamiliarized nonsense syllable list of six pairs was compared with the learning by the same subjects (*S*s) of a list of six pairs of new nonsense pairs under identical learning conditions. All of the nonsense syllables were chosen from Glaze's (1928) list of syllables at the 80% level of associative value.

The prefamiliarization technique employed in this experiment was designed to overcome certain difficulties present in methods previously used by other investigators. The *S*s were required to learn 12 short lists, each consisting of four numbers and one nonsense syllable. Each item in the list was printed individually on a blank card. *S*s read the items aloud and received two trials with every list; a test of total recall followed each trial. In almost all cases the *S* was able to recall the syllable perfectly after the first trial. None of the *S*s suspected the purpose of this procedure. The instructions were as follows:

> This is an experiment to determine how well people learn certain material. I have made up 12 short lists each consisting of 5 items, 4 numbers, and a nonsense syllable (explained if necessary). I want you to try to learn these lists one by one in the following way. . . . At no time will I ask you to recall a list which you have already passed and been tested for, so don't try to keep them all in mind or your task will become impossible.

This procedure differs from previous techniques in two respects. First, the method ensures familiarization by inducing an intention to learn as contrasted with a purposeless repetition of the material (cf. Waters). Moreover, the material is not presented in serial order. The technique of spacing reduces to near zero the possibility that any obtained effect of prior familiarization can be attributed to the existence of remote associations between the syllables rather than to familiarity as such.

The 12 syllables thus familiarized were then paired, thereby constituting one learning list of six pairs. Every effort was made to reduce to a minimum any factors which might cause one pair to be easier than any other, e.g., both members of a pair having identical initial consonants, etc.

The pairs were printed on blank 3 × 5 cards in capital letters. The stimulus item was printed on the bottom left-hand corner of the other side of the card. During learning, each pair was presented for 5 seconds (as measured by metronome) with a 2-second interval between each pair. During the test trials the stimulus item was presented alone for a 5-second interval with a 2-second interval between presentations.

Subjects. Forty-eight college students participated in this experiment. Thirty-two *S*s served in the main experiment and 16 *S*s took part in a supplementary experiment.

Experiment I. The *S*s in the main experiment were divided into two groups. The 16 *S*s in Group 1 were treated in the following way: (*a*) Prefamiliarization session as described above. (*b*) Two learning trials with the list of now familiar items. (*c*) Test after an interval of 1 min. following the second learning trial. (*d*) Two learning trials with new pairs of syllables. (*e*) Test after a 1 min. interval following the second trial. For 8 *S*s of Group 1 the prefamiliarized syllables consisted of those syllables which had been new for the other 8 *S*s. Thus, each item served both as familiar and as new for different *S*s. In Table 1 we refer to this fact by recording the data under two headings, List A and List B. Thus syllable DEV, which was new in List A, was familiar in List B. The results for Group 1 are found in Table 1. The mean number of prefamiliarized pairs learned was 3.1, and the mean for the new pairs, 2.1.

The same procedure was employed for the 16 *S*s in Group 2 except that *S*s in this group always learned and were tested on the new material first and then proceeded to prefamiliarization, followed by learning of the familiar list and test. The results for this group are also presented in Table 1. The mean number of new pairs learned was 2.6, and 3.8 for the familiar pairs.

This experiment was then repeated for the following reason: the new pairs in

List B of the main experiment fared pretty well (particularly in Group 1 and to a much lesser degree in Group 2), with the result that the differences between familiar and new in List B are not as impressive as the differences obtained with List A. For this reason, the 12 syllables making up these six new pairs were interchanged to form different pairs which then constituted the new (nonfamiliar) list for the 16 *S*s participating in this experiment. The syllables to be prefamiliarized were the same syllables which were familiarized in List B of the main experiment. Group 3 consisted of eight *S*s who learned the nonfamiliar list first and then the familiar pairs. These *S*s retained a mean number of 2.9 new pairs and 3.9 familiar pairs. Group 4 consisted of eight new *S*s who learned the familiar list first. The mean number learned was 2.5 for the familiar and 1.4 for the nonfamiliar. Consideration of the frequencies in Table 1 shows that reordering the pairs had the effect of bringing out the difference between the familiar and nonfamiliar syllables. This confirms our conjecture that the factor responsible for the lack of significant difference for this material as given in the original List B is not the ineffectiveness of familiarization but rather the very high level of learning for the new pairs by the *S*s in this group.

Inspection of the last column of Table 1 reveals that the difference between the means for the prefamiliarized and new-syllable pairs are almost identical in the various experimental conditions (1.0, 1.2, 1.0, 1.1), and all are in the expected direc-

TABLE 1

NUMBER OF PREFAMILIARIZED AND NEW SYLLABLE-PAIRS LEARNED IN EXPERIMENT I

Experiment I

Group 1

	List A	List B	Lists A & B	Comb. Mean
Familiar	26	24	50	3.1
New	13	21	34	2.1
N	8	8	16	

Group 2

	List A	List B	Lists A & B	Comb. Mean
New	19	23	42	2.6
Familiar	31	30	61	3.8
N	8	8	16	

Group 3			Group 4	
	Order New-Familiar	Mean	Order Familiar-New	Mean
New	23	2.9	11	1.4
Familiar	31	3.9	20	2.5
N	8		8	

TABLE 2

COMBINED RESULTS FOR EXPERIMENT I

Material	Number of Pairs Learned	Mean Number of Pairs Learned	*SD*
New	110	2.4	1.36
Familiar	162	3.4	1.35
N	48		

Note.—$\bar{x}_n - \bar{x}_f$ is significant at the .01 level; $t = 5.3$.

tion. In Table 2 we have combined the data for all conditions. When this is done, the mean number of nonfamiliar pairs learned is 2.4 and the mean number of familiar pairs is 3.4 for 48 *S*s. The standard deviation is 1.36 and 1.35 for nonfamiliar and familiar pairs, in that order. The difference between the means in favor of familiar pairs is significant at better than the .01 level ($t = 5.3$; $df = 47$).

Experiment II

In this experiment, we used items which are equally familiar but which differ in meaningfulness—we compared nouns with conjunctions and prepositions. If the two types of words were learned equally well, the meaning hypothesis would be invalidated; if, however, an advantage were to be shown by the nouns, then such results would be attributable to the factor of meaning. Nonsense syllables were also used, to be compared with the conjunctions.

Materials and Procedure

Two series composed of three different types of material were used. Each series consisted of three lists of six pairs of items: a list of conjunction and preposition pairs composed of three conjunction pairs and three preposition pairs, a list of six noun pairs, and a list of six nonsense syllable pairs. Two series were used in order to allow for a larger sampling of verbal material and thus reduce the possibility that our results might be attributable to the particular words chosen. An attempt was made to use noun pairs consisting of members not ordinarily paired in everyday use. A check of the Thorndike-Lorge (1944) word count showed that, in general, the nouns, conjunctions, and prepositions we used occur with equal frequency. The nonsense syllables were chosen from Glaze's list of 80% syllables. All of the lists are reproduced in Table 4.

Each pair was printed on a blank white index card. The individual left-hand test items were printed on the back of these cards. Each list was presented to the *S* for one trial, and each pair in this list was presented for 5 seconds as indicated by a metronome. The *S*s were asked to read the pairs aloud (to pronounce, not to spell, the syllables) and to try to associate the items of each pair with one another in preparation for a test of their memory which would follow soon after learning. The *S*s were informed that the sequence was not to be learned since the order of the pairs would be randomized for the test presentation. After one learning trial, the *S*s were asked to work on a paper and pencil maze. This interpolated activity lasted for 1 min. The *S* was then tested by being asked to recall the right-hand member of the pair upon presentation of the left-hand item. This procedure was followed with all three lists in each series. The order of presentation during the test was always randomized by shuffling the cards to a new order. The order in which the different lists (materials) was presented was systematically prerandomized so that the different types of materials followed and preceded each other an equal number of times. Also the order of pairs within each list was changed for each *S*. Each test item was presented for a 4-second interval.

Subjects. Thirty-six college students participated in this experiment. One group of 18 *S*s learned Series I; a second Group of 18 learned Series II. The *S*s were assigned in alternating order to one or the other Series.

Results

The results for this experiment are presented in Tables 3 and 4. For Series I the mean number of pairs learned was 2.7, 1.8,

TABLE 3

NUMBER OF PAIRS LEARNED IN EXPERIMENT II

	Series I	Series II	Series I & II	Combined Mean	*SD*
Nouns	49	55	104	2.9	1.79
Conjunctions & Prepositions	35	31	66	1.8	.97
Nonsense Syllables	12	16	28	.8	.87
N	18	18	36		

Note.—The difference between the mean number of noun pairs retained and the mean number of conjunctions and prepositions was significant at the .01 level ($t = 3.9$). The difference between the mean number of conjunctions and prepositions retained and the mean number of nonsense syllables retained was significant at .001 level ($t = 6.7$).

TABLE 4

ITEM ANALYSIS OF RESULTS IN EXPERIMENTS II AND III

Number of *Ss* Who Responded Correctly to Each Pair

Material Series I	Experiments[a] II	III	Material Series II	Experiments[a] II	III
car—leaf	9	11	boat—wall	10	13
sink—park	9	11	match—rent	9	15
fish—rug	8	12	mat—card	8	12
air—chin	10	13	slip—dog	8	13
wood—shirt	7	14	suit—key	10	12
knee—mask	7	12	pen—sand	10	17
hence—or	6	10	still—if	5	9
also—but	8	9	now—and	6	10
then—yet	6	9	how—nor	4	12
at—from	5	10	in—by	6	10
off—out	5	10	to—for	6	10
down—of	5	8	with—up	4	11
vax—neb	1	6	gos-bif	1	9
muc—yeg	2	9	fij—koz	3	6
het—tas	2	5	jor—gan	4	8
fer—wid	4	8	ril—dut	3	7
mot—daw	3	7	pir—yan	2	8
lav—fow	0	5	dev—ruc	3	7

[a] 18 *Ss* served in each condition.

and .7 for the nouns, conjunctions and prepositions, and nonsense syllables, in that order; for Series II the mean number of pairs learned was 3.1, 1.7, and .9. When the data for Series I and II are combined, the mean number of pairs of nouns, conjunctions and prepositions, and nonsense syllables was 2.9, 1.8, and .8, respectively. The standard deviations were 1.79, .97, and .87, also in the same order.

An item analysis of these results is presented in Table 4. All the differences were highly significant (using a one-tailed test for paired values, nouns vs. conjunction–prepositons, $t = 3.9$, significant at .01 level with 35 *df;* conjunction-prepositions vs. nonsense syllables, $t = 6.7$, significant at .001 level with 35 *df*). An analysis of individual *S* performance revealed that 24 of our total group of 36 learned more noun pairs than conjunction-preposition pairs, 5 *Ss* an equal number of both kinds of material, and 7 *Ss* more conjunction and preposition pairs. Twenty-six *Ss* learned a greater number of conjunction and preposition pairs than nonsense pairs, 6 *Ss* showed no difference, and 4 did better with nonsense material.

The results of Experiment II provide evidence for the facilitating role of meaning per se; they therefore contradict Sheffield's finding that material which is both meaningful and familiar is no easier to learn than merely familiar material. This contradiction is perhaps attributable to Sheffield's conception of meaning which obscures the distinction between a familiar item and one which is meaningful as well.

The significance of the superiority of conjunction and preposition pairs over nonsense pairs will be discussed below (Experiment IV).

Experiment III

Before we can conclude that the results of Experiment II demonstrate the role of meaning (and familiarity) in the *formation* of associations, another possibility must be considered.

Suppose a *S* has associated A with B so that when A is presented he is able to recall B. Köhler (1940) has pointed out that, on the functional level, the reproduction of B must involve two steps. The A item must first be recognized, i.e., the memory trace of A is activated because of its similarity to the present percept of A. The second step is the arousal of trace B (recall by association). Suppose now that the *S* cannot recall B. If there is no difficulty in the recognition of A, how is this failure to produce B to be explained? One possibility is that no bond was formed between A and B in the original learning situation. Another is that the bond was made but for one reason or another the trace of B is not available. For example, if B is a difficult, unfamiliar nonsense item the trace of B may not be readily accessible even though the bond between A and B is well established. The existence of the association could, however, be revealed by the use of a matching test; here, the arousal

of B is facilitated by a recognition process. Hence, failure to recall B is not evidence that the association has not been established.

Thus, the superiority of the nouns over conjunctions and prepositions (and of the latter over nonsense syllables) might be explained by reference to the problem of trace availability. Perhaps all associations were equally well formed in the learning process; however, if traces of nouns (in the B position) are more accessible than those of conjunctions, recall scores for the nouns will be higher.[3] If this were the case, then the differences obtained in Experiment II should disappear when learning is tested by the matching procedure. This would be expected since the accessibility of the associated trace is not critical to performance on a matching test. If, however, differences comparable to those obtained with a reproduction test are present with matching also, then we may assume an effect on the formation of associations.

Materials and Procedure

Experiment III was a repetition of the previous one except that *S*s were tested by a matching procedure rather than by recall. The same material was used and the learning conditions were identical. In the matching test, the A item was presented and the *S* was instructed to select the correct B item from a list containing all of the B items arranged in a circular pattern.

Subjects. Thirty-six college students participated, 18 *S*s learned Series I and the other 18 learned Series II.

Results

The results for Experiment III are presented in Table 5 and other details are given in Table 4. The mean number of pairs learned was 4.3, 3.3, and 2.4 for the nouns, conjunctions and prepositions, and nonsense syllables, in that order (Series I and II combined). The standard deviations were 1.51, 1.64, and 1.54, in the same order. The following differences between the means were significant. Nouns vs. conjunctions and prepositions, $t = 4.1$, at the .01 level; conjunctions and prepositions vs. nonsense syllables, $t = 3.0$, at the .01 level.

We may note, then, that although the absolute scores for all materials were significantly higher than in Experiment II, the differences between the materials were maintained on an almost identical level. This near identity of the differences between the means of the various materials for the two experiments suggests that it is not necessary to assume that there is any additional facilitation of meaningfulness and familiarity in the recall process. The influence of these factors seems to reside entirely in the process of forming associations between the two members of a pair.

Experiment IV

In this experiment we wanted to see whether the superiority of the conjunction-preposition pairs over the nonsense pairs (Experiments II and III) was due entirely to their familiarity rather than to the limited meaningfulness they might possess. For this purpose, we compared them with familiarized nonsense syllables.

Method and Materials

The materials consisted of two lists of 6 pairs each. One list was made up of 3 pairs of conjunctions and 3 pairs of prepositions chosen from the lists in Series I and II of Experiment II. The other list consisted of 6 pairs of nonsense syllables also chosen from the lists in Series I and II of

TABLE 5

NUMBER OF PAIRS LEARNED IN EXPERIMENT III

	Series			Comb.	Comb.
	I	II	I & II	Mean	*SD*
Nouns	73	82	155	4.3	1.51
Conj. & Prep.	56	62	118	3.3	1.64
Non Syl.	40	45	85	2.4	1.54
N	18	18	36		

Note.—The difference between the noun pairs and the conjunction-preposition pairs was significant at the .01 level ($t = 4.1$). The difference between the nonsense syllable pairs and the conjunction-preposition pairs was also significant at the .01 level ($t = 3.0$).

[3] Sheffield's (1946) finding that recall is better when a meaningful item is in the response (i.e., B) position than when it is in the stimulus (i.e., A) position may be explained in this way.

TABLE 6

PAIRS USED IN EXPERIMENT IV

Nonsense Syllables	Conjunctions & Prepositions
daw—lav	off—out
yon—cav	at—from
jor—mot	down—of
vax—fer	how—nor
fij—gos	with—up
ril—gan	now—and

Experiment II. Table 6 contains the materials used in this experiment.

Subjects. Thirty-six college students participated as a group in this experiment.

Procedure. The prefamiliarization procedure was essentially the same as that described in Experiment I with some slight modifications to adjust for a group design. There were two familiarization sessions separated by 48 hrs. At the end of the first session, the *S*s were led to believe that their participation in the experiment was completed. Most expressed surprise when the *E* appeared the second day. After the second prefamiliarization session, one half of the group was asked to leave the room. The remaining group then received one learning trial with the prefamiliarized nonsense syllable now presented in 6 pairs, followed by an interpolated interval of 1 min. filled with work on matchstick problems. *S*s were then tested by being required to reproduce in writing the B item upon being presented with the A member of the pair. When this was completed, the conjunction and preposition pairs were learned and tested for in the same way. Finally, the second group reentered the room and followed the same procedure except that this group learned the conjunctions and prepositions first.

Results

The results for this experiment appear in Table 7. When the data for both groups are combined, the mean number of pairs retained for the two different materials is identical (2.6). The standard deviations were 1.14 and 1.51 for the prefamiliarized syllables and conjunctions-prepositions, respectively. A further look at the individual scores reveals that 17 of the 36 participating *S*s learned a greater number of syllables than conjunctions and prepositions, 15 learned a greater number of conjunction and preposition pairs, and 4 of the 36 *S*s, an equal number of both materials.

Since we have found no difference between familiarized syllables and conjunctions we may assume that the superiority of the latter material in Experiments II and III is attributable solely to its familiarity. The further advantage shown by the nouns in those experiments, therefore, confirms the hypothesis that meaning acts as a separate factor in learning.

Experiment V

The experiments reported so far support the view that the advantage of meaningfulness in learning cannot be attributed to familiarity. The nouns and conjunctions we used occur with approximately equal frequency in the language. But there is another kind of familiarity to be considered—that of certain sequences of words. Although the particular pairs of nouns employed in our experiments may not have been frequently experienced together, it might be argued that they have occurred more often than the pairs of conjunctions. In everyday speech and writing we often list series of nouns so that there is some degree of probability that we have already experienced one or more of the noun pairs used in Experiment II. It is much less likely that any of the conjunction or preposition pairs have occurred previously. Consequently, on the basis of the Miller and

TABLE 7

NUMBER OF CONJUNCTION, PREPOSITION, AND PREFAMILIARIZED SYLLABLE-PAIRS LEARNED IN EXPERIMENT IV

Material	No. Retained	No. Retained		
	Order Syl.-Conj. & Prep.	Order Conj. & Prep.-Syl.	Comb. Mean	Comb. *SD*
Conj. & Prep.	50	42	2.6	1.51
Prefam. Syl.	45	48	2.6	1.14
N	18	18		

Note.—No difference between the means.

Selfridge results, one could predict the superiority of the noun pairs.

(Another possible explanation of the results of Experiment II is provided by the grammatical habit hypothesis.[4] This view stresses conformity with grammatical use rather than the statistical frequency of specific word sequences.)

We do not wish to deny the role of the transitional probability factor in learning; we wish to suggest, however, that it is not sufficient to account for our results. In order to test this view, we need to compare our noun pairs with pairs of words which occur together much more frequently but which cannot be readily organized into conceptual units. For example, the words "here—is" have a high sequential probability but neither word has the meaningfulness of a noun. If the noun pairs were to do better than material of this kind, then the transitional probability approach could not explain the results of our previous experiments.

We decided also to compare pairs such as "here—is" with our conjunction-preposition pairs. The effectiveness of sequential probability would be demonstrated if the new material were learned better.

Since there has been no systematic computation of the transitional probability of word sequences we chose material in the following way: we scanned several books and selected pairs of contiguous words which occurred together quite frequently.

Material and Procedure

Two different series of word pairs were used. In each series there were three lists of six pairs each. List A in each series was composed of material selected as described above. We are confident that the reader examining the pairs of List A will agree that they possess high transitional probability. (See Table 8.) Nevertheless, these words cannot be readily organized into conceptual units. List B consisted of the conjunction-preposition pairs and List C the noun pairs which were used in Experiment II. The experimental procedure was identical with that used in Experiment II. The order in which the three lists were presented was systematically randomized. The order within each list was also randomized from the learning trial to the test and between *S*s.

Subjects. There were 36 college students in the experiment. One half of these learned Series I and the other half Series II.

Results

The results are shown in Tables 8 and 9. For Series I the mean number of pairs learned was 2.3, 2.1, and 3.4 for Lists A, B, and C, respectively. The standard deviations were .79, .89, and 1.12. The difference between the mean obtained with List C and the

TABLE 8

ITEM ANALYSIS OF RESULTS BY EXPERIMENT V

The Number of *S*s Who Responded Correctly to Each Pair

Series I		Series II	
Pair	*N*	Pair	*N*
List A		List A	
are—not	9	before—any	9
such—an	4	here—is	11
will—have	9	and—does	5
am—more	5	was—under	5
which—makes	5	then—it	11
that—this	9	follows—the	11
List B		List B	
down—of	7	now—and	6
then—yet	5	still—if	9
off—out	4	how—nor	4
at—from	6	with—up	4
also—but	9	to—for	5
hence—or	7	in—by	8
List C		List C	
knee—mask	10	match—rent	9
air—chin	10	mat—card	8
fish—rug	10	suit—key	13
sink—park	9	slip—dog	14
wood—shirt	10	boat—wall	15
car—leaf	12	pen—hand	15

[4] We wish to thank Susan M. Ervin for calling our attention to this possibility. Personal communication. 1958.

TABLE 9

MEAN NUMBER OF PAIRS LEARNED IN EXPERIMENT V

	Series I		Series II		Combined	
	Mean	*SD*	Mean	*SD*	Mean	*SD*
List A	2.3	.79	2.9	1.09	2.6	.96
List B	2.1	.89	2.0	.91	2.05	.88
List C	3.4	1.12	4.1	.95	3.75	.83

Note.—All of the relevant differences are significant at the .01 level with the exception of $\bar{x}_a - \bar{x}_b$, Series I, which is not significant.

mean obtained for List A and List B is significant at the .01 level. The difference between the means for List A and B is not significant.

For Series II the mean number of pairs learned was 2.9, 2.0, and 4.1 for Lists A, B, and C, respectively. The standard deviations were 1.09, .91, and .95. The mean for List C was significantly better than the mean for List A, and this in turn was significantly better than the mean for List B.

The combined means for both series were 2.6, 2.05, and 3.75 for Lists A, B, and C. The standard deviations for the combined means were .96, .88, and .83. All of the differences were significant at better than the .01 level.

The results give evidence for the role of sequential probability—as shown by the superiority of List A over List B (combined means of Series I and II). But the even greater superiority of the nouns clearly supports the view that the role of meaning cannot be reduced to familiarity of the transitional probability kind.

Experiment VI

We had obtained evidence that meaning plays a role in associative learning above and beyond the facilitation due to familiarity and transitional probability. We then attempted to develop further data in support of Köhler's organization hypothesis.

We chose materials which varied in the extent to which they permitted the formation of conceptual units. Concrete nouns—referring to a specific object or thing, such as "suit," "chair," "dog," etc.—should be easy to build into a unified concept. Abstract nouns—referring to emotions, ideas, etc., such as "grief," "time," "war," etc.—on the other hand, should be more difficult to organize. One can, for example, unify the pair "cat—leaf" by thinking of a cat playing with or eating a leaf. It would be more difficult to do something similar with the abstract word pair "law—time." Our hypothesis predicts, therefore, that concrete noun pairs should be learned more easily than abstract ones. Drawings of specific objects were also employed. We felt that visual representations would be unified easily since the *S* would actually perceive the two objects together. We expected the drawings to do even better than the concrete nouns. We selected verbs as the final class of material. In this case our expectation was that verb pairs would probably not be as easy to organize as concrete nouns. Our hypotheses did not permit a prediction as to the relative difficulty of learning verbs and abstract nouns.

Materials and Procedure

Two series of four lists were constructed. Each series was composed of one list of six pairs of pictures of objects, one list of concrete nouns, one of abstract nouns, and one of verbs. The material is presented in Table 10 and Figures 1 and 2.

Each *S* learned all four lists. Each list was presented for one trial at the rate of one pair every 5 seconds. The *S*s read the pairs or gave the name of the depicted objects aloud under instructions to learn the list in preparation for a test

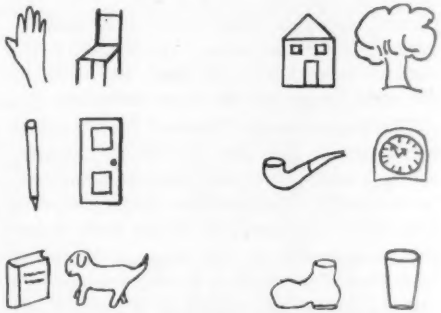

FIG. 1. Pairs of pictures of objects used in Experiment VI, Series A.

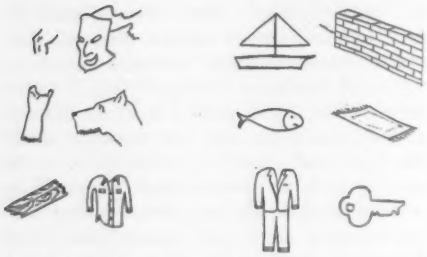

FIG. 2. Pairs of pictures used in Experiment VI, Series B.

in which they would be asked to supply the missing right-hand item upon presentation of the left-hand item. When the learning trial was completed, *E* took 30 seconds to randomize the order of the pairs and to remind *S* very briefly of his task. The test was then given. This procedure was followed for all four lists individually. The order in which the lists were presented was systematically prerandomized so that every list followed and preceded every other list an equal number of times. The order of pairs within the list was randomized from *S* to *S*.

The purpose of the two series (A and B) was to control for possible chance bias in the material. The pictures of Series A were presented as concrete nouns in Series B, and the concrete nouns in Series A were presented as pictures in Series B. In addition, Series B contained completely new lists of abstract nouns and verbs.

Subjects. Forty-eight college students served as *S*s. Twenty-four *S*s learned the material in Series A and 24 *S*s learned Series B.

Results

The results are presented in Tables 10 and 11. The mean number learned for Series A was 3.9, 3.1, 2.3, and 1.9 for the picture, concrete noun, verb, and abstract noun lists, in that order. The standard deviations were 1.34, 1.70, 1.67, and 1.30, in the same order for the four materials.

The mean number learned for Series B was 3.8, 3.0, 2.3, and 2.2 for the picture, concrete noun, verb, and abstract noun lists, in that order. The standard deviations were 1.18, 1.33, 1.52, and 1.34, in the same order.

A comparison of the data of Series A with that of Series B as it relates to pictures and concrete nouns will show that the effects obtained are not produced by any chance bias of material.

When the data for Series A and B are combined, the means were 3.9, 3.0, 2.3, and 2.0 for the pictures, concrete nouns, verbs, and abstract nouns, in that order ($N = 48$). All of the differences were significant except for the obtained difference between the abstract nouns and the verbs. See Table 8 for analysis of variance and q test. The results of this experiment confirm our expectations. Performance was enhanced as a direct function of the possibility of forming conceptual units.

TABLE 10

ITEM ANALYSIS OF RESULTS FOR EXPERIMENT VI

The Number of *S*s Who Responded Correctly to Each Pair

Series A		Series B	
Concrete Nouns		Pictures	
suit—key	13	suit—key	17
fish—rug	14	fish—rug	15
knee—mask	10	knee—mask	14
wood—shirt	10	wood—shirt	13
slip—dog	11	slip—dog	15
boat—wall	17	boat—wall	18
Pictures		Concrete Nouns	
house—tree	19	house—tree	14
boot—glass	12	boot—glass	10
pencil—door	13	pencil—door	11
hand—chair	16	hand—chair	12
pipe—clock	17	pipe—clock	12
book—dog	17	book—dog	13
Abstract Nouns		Abstract Nouns	
fame—height	9	death—mood	9
law—time	8	mind—greed	8
truth—grief	7	luck—norm	8
peace—fate	5	pride—age	8
vice—life	9	weight—ideal	9
joy—oath	8	glee—worth	9
Verbs		Verbs	
sang—walked	10	bought—hopped	9
wrote—threw	9	planned—shook	9
brings—melts	8	slept—rang	10
found—jump	9	flows—thinks	9
looks—takes	9	pour—join	9
dives—helps	10	opens—grows	10

One might have thought that the *S* would be able to unify the verb pairs by imagining an individual performing two actions at the same time—e.g., singing while walking. If this did occur it apparently was not as successful in establishing connections as was the conceptualization process involving nouns.

Experiment VII

In this experiment we put the organization thesis to a more direct test. If the hypothesis is correct, then material learned under conditions which encourage the formation of a unit should fare better than material presented under conditions which do not in any special way facilitate the occurrence of unit formation.

Experiment VIIa

Method and materials. Two lists of 6 pairs of concrete noun pairs were constructed. In one list these nouns were joined (or separated) by a third word which constituted an intelligible connective. Thus, we formed a list of three word phrases each of which comprised a unit, e.g., *bank* on *roof, lamp* in *bottle.* A second list consisted of the same noun pairs but now joined by an irrelevant connective, that is, one which did not serve the purpose of unit formation, e.g., *bank* late *roof, lamp* how *bottle.* In each list three different connectives were used, each serving twice. In the first list the words, on, in, near, were used. In the second list the words how, but, late, were used. (See Table 12.)

The instructions were as follows:

> This is an experiment to find out how well people learn certain materials. I am going to show you a series of six 3-word phrases. In each phrase the first and last words have been underlined. I want you to read aloud the *entire* phrase as I present it to you and try to learn the underlined words in each of the phrases. That is, try to learn the first and last words in each phrase. After you have read through all six phrases once, I will show you the first underlined word of each phrase and ask you to tell me from memory what the second underlined word is in that phrase. You will *not* be asked to recall the middle word. I am only interested in how well you can learn the underlined pairs.

Each phrase was typed on a blank white index card and was presented for a 5-second interval. After one trial was completed 3 seconds were allowed to elapse while *E* randomized the order and made certain the *S* understood his task. The *S* was then shown the first word of each phrase and asked to respond with the correct missing underlined word.

Subjects. Forty *S*s served in this experiment. Group 1, consisting of 20 *S*s, learned the first list, and Group 2, also consisting of 20 *S*s, learned the second list.

Results. The results for this experiment are presented in Tables 12 and 13. The mean number retained for Group 1 was 3.8 (SD = 1.41). The mean number retained for Group 2 was 2.7 (SD = 1.64). This difference in favor of Group 1 is highly

TABLE 11

NUMBER OF PAIRS LEARNED IN EXPERIMENT VI

	Series A			Series B			Series A & B	
	Number Retained	Mean	*SD*	Number Retained	Mean	*SD*	Number Retained	Mean
Pictures	94	3.9	1.34	92	3.8	1.18	186	3.9
Concrete Nouns	75	3.1	1.70	71	3.0	1.33	146	3.0
Abstract Nouns	45	1.9	1.30	52	2.2	1.34	97	2.0
Verbs	55	2.3	1.67	56	2.3	1.52	111	2.3
N	24			24			48	

Note.—A simple analysis of variance yielded an F ratio of 16.6 (an F of 2.65 required at the .01 level). A q test for the difference between the means yielded the following results (q = 0.80 at the .01 level). The difference between the pictures and the concrete nouns was significant (q = 0.90). The difference between the pictures and the abstract nouns was significant (q = 1.9). The difference between the pictures and the verbs was significant (q = 1.6). The difference between concrete nouns and abstract nouns was significant (q = 1.0). There was no significant difference between the abstract nouns and the verbs (q = 0.30). The difference between the concrete nouns and verbs was significant at the .05 level (q = 0.70).

TABLE 12

ITEM ANALYSIS OF RESULTS FOR EXPERIMENT VIIa

The Number of *Ss* Who Responded Correctly to Each Pair

Group 1 (N = 20)		Group 2 (N = 20)	
Material	No. of Corr. Resp.	Material	No. of Corr. Resp.
cake near *road*	13	*cake* but *road*	9
box near *cloud*	11	*box* late *cloud*	8
shoe on *lake*	12	*shoe* but *lake*	8
bank on *roof*	13	*bank* late *roof*	9
lamp in *bottle*	14	*lamp* how *bottle*	9
card in *sand*	13	*card* how *sand*	10
Group 3 (N = 20)		**Group 4 (N = 20)**	
Material	No. of Corr. Resp.	Material	No. of Corr. Resp.
cake—road	8	*cake* and *road*	7
box—cloud	8	*box* and *cloud*	6
shoe—lake	8	*shoe* without *lake*	9
bank—roof	9	*bank* or *roof*	7
lamp—bottle	8	*lamp* or *bottle*	9
card—sand	7	*card* without *sand*	8

significant (t = 2.44, significant at the .01 level).

Before we accept these findings as evidence for the hypothesis, we must consider a possible objection. It can be argued that the conditions of learning for Group 2 actually inhibited performance and thus do not provide a fair test of our thesis. The middle word for Group 2 may have interfered with the link between the first and last words, thus lowering the scores. We may ask why the middle word did not have this effect for Group 1. An obvious answer would be that for this group the middle word helped the learner form a unit and thus enhanced instead of inhibited the learning. This, however, is precisely the point.

To check on the validity of this criticism, we decided to run a control group which would learn the same pairs as Group 1 and Group 2 without the presence of any kind of connective between the pair members (Group 3). If the irrelevant connective served to interfere with learning or recall, then eliminating the connective ought to make the control group performance superior to the performance of Group 2.

Twenty adults drawn from the same population as Groups 1 and 2 served as the *Ss* for this control group. The same learning conditions were maintained except for a change in the wording of the instructions to eliminate sections which did not pertain to this design.

TABLE 13

NUMBER OF PAIRS LEARNED IN EXPERIMENT VIIa

	N	No. Retained	Mean	SD
Group 1	20	76	3.8	1.41
Group 2	20	54	2.7	1.64
Group 3	20	48	2.4	1.32
Group 4	20	46	2.3	1.18

Note.—Group 1 vs. 2: t = 2.44; significant at the .05 level. No difference between Group 2 and Group 3 (t = 0.60). The difference between Group 1 and Group 4 is significant at the .01 level.

The mean number of pairs retained was 2.4. The standard deviation was 1.32. The difference between the means for the Control group and Group 2 was not significant ($t = .60$).

A second objection might be raised on the basis of grammatical habits. Although the particular three-word sequences do not occur very often, the connectives used in the word pairs learned by Group 1 created a triad more in accordance with grammatical structure than was the case for Group 2. For example, the phrase "lamp in bottle" is a more natural grammatical sequence than "lamp how bottle." Moreover, the triads for Group 1 have a greater transitional probability than those for Group 2; some of the latter would represent a zero-order approximation to English (cf. Miller & Selfridge). Thus, both the grammatical habit and sequential probability hypotheses predict that the Group 1 material would be learned more readily. No reference to meaning would be necessary.

To test this possibility, we repeated the experiment with the same word pairs but employed different words to connect them. The connectives were chosen so that the triads would be as grammatically natural and would have the same transitional probability as the material used for Group 1. However, these connectives would not aid the formation of conceptual units. The sequence "lamp or bottle" is as good grammatically and is as probable as "lamp in bottle." But according to the organization viewpoint, the word "or" does not facilitate unit formation.

Materials and method. The materials used with Group 4 are shown in Table 12. The procedure was identical with that used for Groups 1 and 2.

Subjects. Group 4 consisted of 20 college students.

Results. The mean number of pairs learned was 2.3 with a standard deviation of 1.18. This result should be compared with the mean of 3.8 obtained by Group 1. The difference of means is significant at the .01 level. Furthermore, Group 4 does no better than Groups 2 or 3.

The experiment gives a decisive answer. Whatever role one assigns to grammatical habits and transitional probability in verbal learning, it is clear that these factors cannot fully account for the present results. The possibility of unit formation seems to be the crucial factor.

Experiment VIIb

In this experiment our purpose and design was similar to Experiment VIIa, except that pictures were used. Group 1, consisting of 20 *S*s, learned six pairs of outline pictures of familiar objects, e.g., card—glass. The pictures were drawn so that each pair constituted a unit. Thus, a "card in a glass" was presented. See Figures 3 and 4 for reproductions of the pictures used in this experiment.[8] Group 2, consisting of 20 *S*s, learned the same six

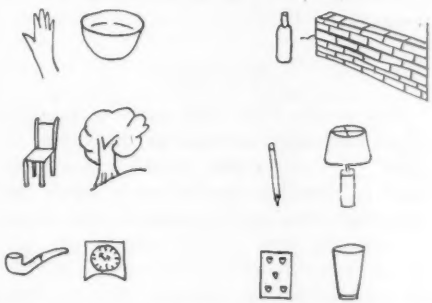

FIG. 3. Pairs learned by Group 2, Experiment VIIb.

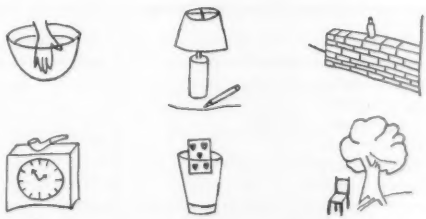

FIG. 4. Pairs learned by Group 1, Experiment VIIb.

[8] This technique of joining items into an integral unit is analogous to one first employed by Asch, Ceraso, and Heimer (1960).

pairs of pictures. For this group, however, the members of each pair were presented in the traditional paired-associate manner.

The instructions given to *both* groups were:

> You will be shown six pairs of pictures of things you have seen often. I want you to try and learn these pictures, that is, try and learn which pictures are paired together. After we have gone through the list once, I will show you one of the pair and ask you to tell me verbally what you remember the missing partner to be.

Each pair was presented for 5 seconds, and a 30-second interval followed the last presentation. The test order was randomized.

Results. The results for this experiment are presented in Table 14. Group 1 learned a mean number of 4.9 pairs ($SD = 1.35$). Group 2 learned a mean number of 3.3 pairs ($SD = 1.26$). This difference is highly significant ($t = 3.6$, significant at the .01 level).

Discussion

Our results show that pairs of familiar items are easier to associate than pairs of novel ones. Why this should be so is not entirely clear but one reason is surely the fact that with familiar material the *S* has less to learn. Since he already knows the individual items, he is free to concentrate on forming a bond between them.

In his discussion of the organization hypothesis, Köhler does not mention the role of familiarity. It is clear, however, that emphasis on meaning is perfectly compatible with acceptance of the importance of familiarity as well. The real issue, we believe, is whether the effect of meaningfulness in learning is reducible to familiarity of any kind. In the series of experiments reported above we have attempted to prove that such a reduction is not possible. Meaning appears to be an independent factor.

Although meaning is a result of past learning it enables the *S* to go beyond what he has learned. Similarly, while insight in problem solving may be based on past experience, it is not simply a reproduction of the past but represents something new. When the *S* knows the meanings of words he can "play" with them and put them into new combinations. This possibility makes them easier to associate than nonsense syllables or familiar but less meaningful items. When we refer to these combinations as conceptual units we do not wish to imply that such units are sensible or logical. They are conceivable or imaginable.

TABLE 14

Results of Experiment VIIb

Pairs of Pictures Learned

Material	Group 1 ($N = 20$)	Group 2 ($N = 20$)
pipe—clock	18	11
card—glass	15	7
chair—tree	18	11
bottle—wall	16	12
pencil—lamp	15	10
bowl—hand	16	11
Total	98	66
X	4.9	3.3
SD	1.35	1.26
$t_{\bar{x}_1 - \bar{x}_2}$	3.6**	

** Significant at .01 level.

Many investigators, in recent years, have perhaps too hastily concluded that the results of their experiments make unnecessary any reference to the role of meaning as we have described it. But as we have already stated, evidence in favor of a habit explanation does not prove that this is the only possible explanation.

For example, according to Noble (1952a) "meanings are habits" (p. 429). The greater the number of responses conditioned to a particular stimulus the more meaningful is this stimulus. He advances an operational index of stimulus meaning which is the "mean frequency of continued written associations made by subjects within a 60 sec. time interval" (1952a, p. 429).[6] Noble assumes that this index (*m* value) is an important variable in verbal learning. A serial learning experiment (1952b) showed that *m* value was positively correlated with ease of learning. Presumably the facilitative effect of high *m* value would follow from the associationist explanation outlined above on page 1.

If we were to apply Noble's *m* value (or Mandler & Huttenlocher's [1956] *f* value) index to our material, it might be assumed that concrete nouns would elicit more associations than conjunctions or abstract nouns. Informal tests confirm this assumption. Thus, the superiority of concrete nouns might be explained as the outcome of high *m* values. Yet our explanation cannot be ruled out, unless one can find a situation for which the two hypotheses make different predictions. Noble's hypothesis would predict that the concrete nouns should be learned more readily, not only as paired associates but in serial learning as well. On the basis of the organization view, we would argue that, in the learning of a series, the formation of conceptual units would be quite difficult, since the words are presented in a continuous sequence. Therefore, the concrete nouns might do no better than other kinds of material, especially when only one or two presentations are given. Preliminary data obtained by John Catalano[7] yield the following means for the number of items recalled by 23 *S*s after one learning trial each (using a test of free recall) with a list of 12 concrete nouns, a list of 12 conjunctions and prepositions, and one of abstract nouns: 8.9, 8.7, and 8.0, respectively. These results are contrary to the *m* value hypothesis. Further research on this problem is in progress.

To explain the superiority of picture pairs over the other kinds of material and the superiority of concrete nouns over verbs found in Experiment 6, in terms of associative value, it would be necessary to obtain corresponding differences in *m* value. This seems unlikely. Moreover, the fact that the pairs in List A of Experiment 5 are not as well learned as noun pairs argues against the Mandler and Huttenlocher interpretation. In this case, the words have been linked together frequently so that no mediating bridges would be needed to aid in the formation of a bond.

While Noble and Mandler and Huttenlocher agree that meaning, as defined by them, does benefit learning, Sheffield (1946) finds no facilitative effect. This failure may be an outcome of the way in which he attempted to make a term meaningful. Attaching such responses as blacking out the word or putting a staple through it does not provide the kind of meaning that would favor the formation of associations.

Another factor in the effect of meaningfulness which we have not discussed has been suggested by Sheffield. Meaning, as an internal response, facilitates learning because of its role in making for stimulus differentiation. The words "cup" and "cut" as sheer sounds are very similar. But the unique internal responses attached to each differentiates the two items and thus operates to reduce interference. However, Sheffield's own data do not support this hypothesis since meaning did not yield any benefit in addition to familiarity. Nor does

[6] Noble eliminates clang and tangential associations unrelated to the meaning of the stimulus term. This procedure shows that *m* value is not identical with meaning; these associations are dependent on *S*s knowledge of the meaning of the word. It is not clear what associations to a nonsense syllable signify.

[7] Brooklyn College.

this view account for the differences obtained in Experiments 6 and 7.[8]

Another example where results supporting their hypothesis led the investigators to conclude that meaning is not an independent factor is provided by the Miller-Selfridge experiment. These authors emphasize their finding that some sequences of a third or fourth order of approximation are learned as well as text passages. They interpret this result as evidence that learning depends not on the meaningful nature of the sequence but on the presence of familiar short range associations between words.

It is interesting to find that this experiment was repeated with some modification by Marks and Jack (1951). Instead of testing by means of free recall, they required the *S*s to reproduce the words in the same order in which they had been presented during learning. They argue that this method provides a better test of the Miller and Selfridge hypothesis which stresses short range association. In contradition to the earlier experiment, Marks and Jack found that "recall seems to be very much a function of the *a priori*, relative meaningfulness of the materials" (p. 300).

Intuitively, it did not seem possible to us that text passages would not be learned more easily than some of the lower orders of approximation. Therefore, we selected two passages from the Miller and Selfridge material which according to their result were learned as well as text and repeated their experiment with the identical procedure. The results for 16 college students were:

1. Twenty-word passage, third-order approximation—52% recall.

Twenty-word text passage—78% recall.

2. Thirty-word, fourth-order approximation—58% recall.

Thirty-word text passage—72% recall.

We have no explanation for the discrepancy but our results, together with those of Marks and Jack, suggest that Miller and Selfridge have not ruled out meaning as a factor in verbal learning. It should be pointed out, in addition, that their own data might be explained in terms of "short range meanings" as well as short range associations.

One final example: grammatical sequences of words can be learned better than random sequences of the same length. This may be a result of transfer from previously established grammatical habits. However, a grammatical sequence is usually meaningful (of course in a more complex sense than is the case for an isolated word) and the role of meaning may be independent of grammatical habits. Again, evidence in support of one factor does not eliminate the other. Experiments analogous to the ones reported in this paper could perhaps assess the separate effects of each. For example, *S*s might be given the task of learning two passages equally well structured grammatically but differing in meaningfulness. (Perhaps a passage from Hegel and one from Bertrand Russell?)

It is important to clarify the sense in which we use the term "organization" in connection with Köhler's hypothesis. We would agree with Postman and Riley (1957) that in the case of verbal learning, the term "organization" as it is used in perception, with its implications relating to a specific brain model, is inappropriate. We use it in the present context only to refer descriptively to the possibility which Köhler discusses, namely, that the learner finds it easy to relate meaningful items to one another, to imagine the component items in some relation or juxtaposition to one another. Although this is intuitively understandable, further research is required to clarify why it is easier to organize meaningful items than other types of items.

[8] Another possible explanation of some of our findings, which is suggested by Sheffield, is that meaningful material more readily lends itself to that type of mnemonic device involving intermediary links. Thus, for example, "pen—hand" may suggest "pen—write—hand" to the learner. It is doubtful, however, that this could occur or did occur very often. Furthermore, it is not obvious how the results of Experiments V and VI would follow from this view.

SUMMARY

The roles of familiarity and meaning in associative learning were investigated.

Experiment I revealed the effect of familiarity: prefamiliarized nonsense syllables were learned better than novel ones.

In Experiment II a group of *S*s learned three lists of six pairs of words: a list of nouns, a list of three conjunction pairs and three preposition pairs, and a list of nonsense syllable pairs. The nouns were considered to be meaningful and familiar, conjunctions and prepositions primarily familiar, and syllables neither familiar nor meaningful. The results showed that nouns were better learned than conjunctions and prepositions, and these in turn were better learned than the syllables.

Experiment III was an attempt to localize the influence of meaning and familiarity. Experiment II, therefore, was repeated, this time using matching instead of reproduction to test learning. Although the absolute level of performance was enhanced as compared with Experiment I, the relative differences between materials remained the same. We concluded that in our experiments meaning and familiarity operated almost entirely to facilitate the formation of the associations.

Experiment IV was designed to determine whether the advantage of conjunctions and prepositions in Experiments II and III is due to familiarity or to limited meaning. Prefamiliarized nonsense syllables were learned as well as conjunctions and prepositions, showing that familiarity was the crucial factor.

Experiment V provided evidence relating to the role of sequential probability in our experiments. The results indicated that while this factor does facilitate learning to some extent, it is not sufficient to account for our earlier findings.

In Experiment VI we tested the possibility that meaningful material allows for the formation of conceptualizable units which combine the separate items into a new whole. The *S*s learned four lists composed of six pairs each: a list of pictures of real objects, a list of concrete nouns, a list of verbs, and a list of abstract nouns. We assume that these varied in respect to the readiness with which they could be formed into novel units. The results showed that pictures were learned better than concrete nouns which in turn were superior to verbs and abstract nouns. The verbs and abstract nouns did not differ significantly.

In Experiment VIIa we investigated further the hypothesis that the conceptualization of objects is facilitating because it encourages the formation of units. Two groups of *S*s learned six pairs of concrete nouns. Group 1 learned the pairs as parts of a three-word phrase in which the middle word was an intelligible connective under conditions which encouraged unit formation. Group 2 learned the same pairs as parts of a three-word phrase where the middle word did not reasonably connect the two members of the pair. Performance for Group 1 was superior to Group 2. A third group served as a control. This group learned the same six pairs but with no connective whatsoever. The performance of this group was not significantly different from Group 2. A fourth group learned phrases which formed sound grammatical units but did not form good conceptual units. This group was not significantly different from the control.

In Experiment VIIb we used six pairs of pictures of familiar objects. For Group 1 the two pictures of each pair were presented as one unit. For Group 2 the pairs were presented in the traditional paired-associate manner. Group 1 was highly superior to Group 2.

These experiments were considered in their relation to the explanations offered to account for the role of meaningfulness.

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